CAMAS CREEK
Total Maximum Daily Load
Implementation Plan for Agriculture

Developed for the Idaho Department of Environmental Quality
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In Cooperation With
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Wood River Watershed Advisory Group
Idaho Department of Agriculture
Natural Resources Conservation Service

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Introduction

Purpose

The purpose of this implementation plan is to identify and recommend best management practices (BMPs) needed to meet Total Maximum Daily Load (TMDL) targets within the Camas Creek Subbasin and its tributaries. This implementation plan will satisfy requirements described in Idaho Code 39-3601 et seq.

TMDL

A total maximum daily load (TMDL) is a term used in the Clean Water Act to mean loading capacity or assimilative capacity of a stream. A TMDL is the maximum amount of pollutants that a stream can assimilate without exceeding the State of Idaho's water quality standards and without impairing the beneficial uses of the stream.

Goal

The agricultural component of the Camas Creek TMDL Implementation Plan outlines an adaptive management approach for the implementation of BMPs and the development of Resource Management Systems (RMS) plans to meet the requirements of the Camas Creek TMDL. The goal of this plan is to assist and/or compliment other watershed efforts in restoring and protecting beneficial uses for 303(d) and TMDL listed stream segments. The listed segments are identified in Table 1.

Table 1. Impaired waters of the Camas Creek Subbasin

Stream	Pollutant(s)
Camp Creek	Sediment , Temperature
Elk Creek	Sediment
Soldier Creek	Sediment, Temperature
Corral Creek	Sediment, Temperature
Cow Creek	Sediment, Nutrients
Wild Horse Creek	Sediment, Bacteria, Temperature
Dairy Creek	Sediment, Nutrients
McKinney Creek	Sediment
Camas Creek	Sediment, Nutrients, Temperature
Mormon Reservoir	See Dairy and McKinney Creek
Little Beaver Creek	Temperature
Beaver Creek	Temperature
Willow Creek	Temperature

Objective

The major objective of this plan will be to reduce the amount of sediment, bacteria, and nutrients entering these streams and lower water temperatures where feasible. Agricultural pollutant reductions will be achieved through application of RMS developed and BMPs implemented on site with individual agricultural operators. Another objective of this plan will be to conduct BMP effectiveness evaluations and monitoring as it relates to pollutant loading and the designated beneficial uses of the streams listed above. Emphasis will also be placed on the implementation of a water quality outreach program to encourage landowner participation in water quality implementation efforts within the watershed. The status and success of the agricultural implementation plan will be communicated to the other involved land management agencies.

Background

Project Setting

The Camas Creek Subbasin is located within a high intermountain valley in south central Idaho (Figure 1) between the Snake River Plain to the south and the Sawtooth Mountains to the north with Big Smokey Dome (Soldier Mountain), elevation 10,095 feet, and Iron Mountain, elevation 9,714 feet, overlooking the prairie from the north. Located predominantly within southern Camas County (Figure 2), the Camas Creek Subbasin covers approximately 700 square miles, or 446,687 acres, straddling Elmore County on the west and Blaine County on the east (Figure 3). Bordered on the south by the Mount Bennett Hills, with Davis Mountain, elevation 6,806 feet, and Twin Mountain, elevation 6,236 feet, the valley is oriented west to east with Camas Creek flowing into Magic Reservoir at the east end of the watershed. This creates a 40-mile long intermountain valley about 10 miles wide. Referred to locally as the Camas Prairie, the area consists of 15 subwatersheds, 12 of which enter Camas Creek from the north like a comb (Figure 4 and Table 2). The four largest of these subwatersheds, Willow Creek, Elk Creek, Soldier Creek and Corral Creek, total 111,866 acres of drainage to Camas Creek (Table 2). Fairfield, the Camas County seat, is the local population and business center.

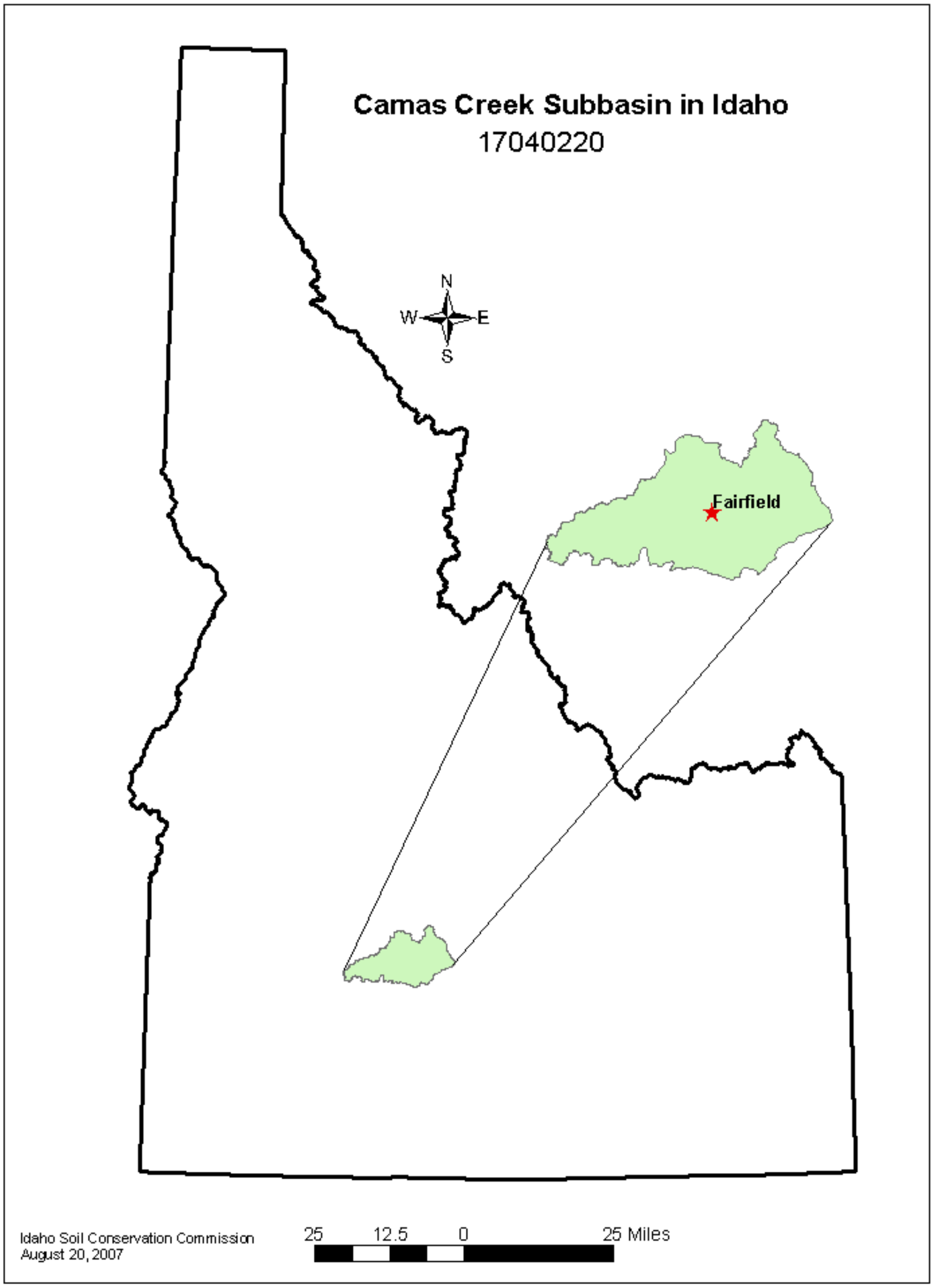


Figure 1. Camas Creek Subbasin in Idaho

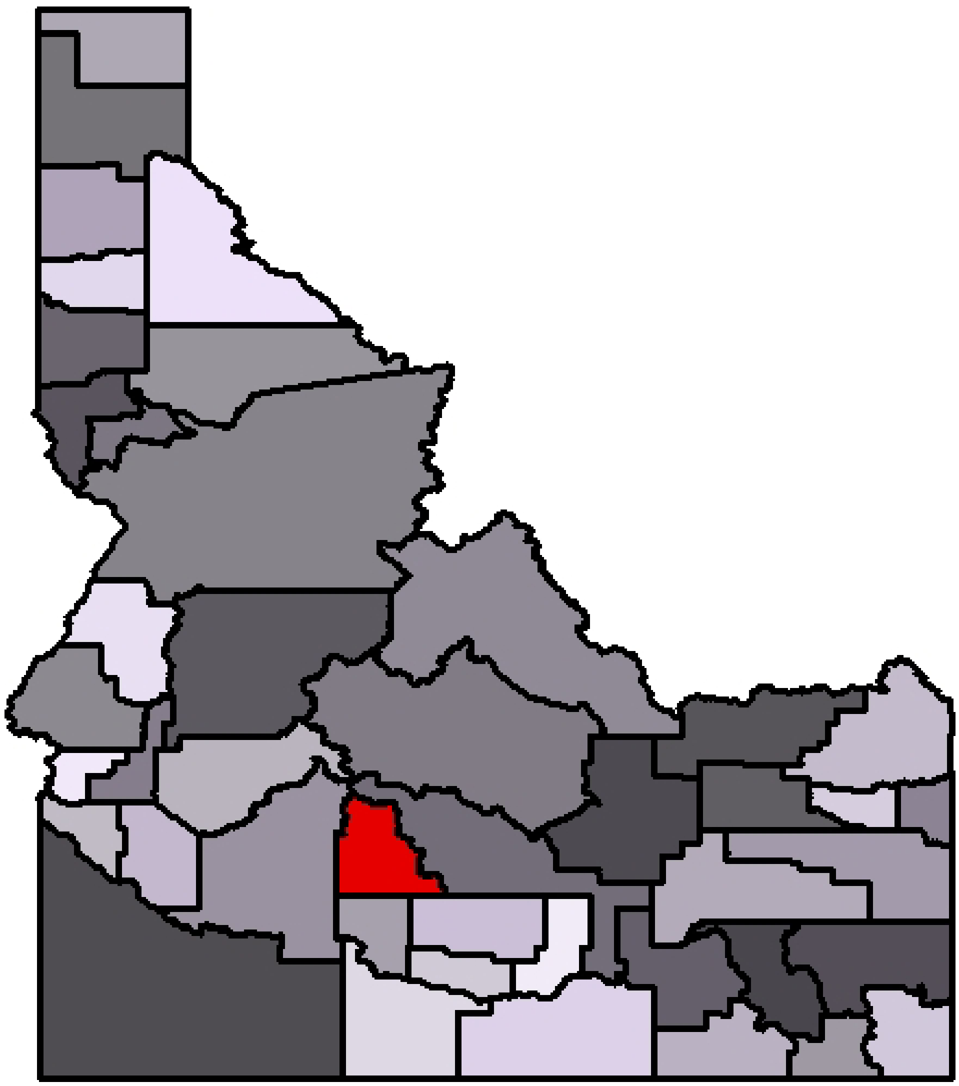


Figure 2. Location –Camas County within Idaho

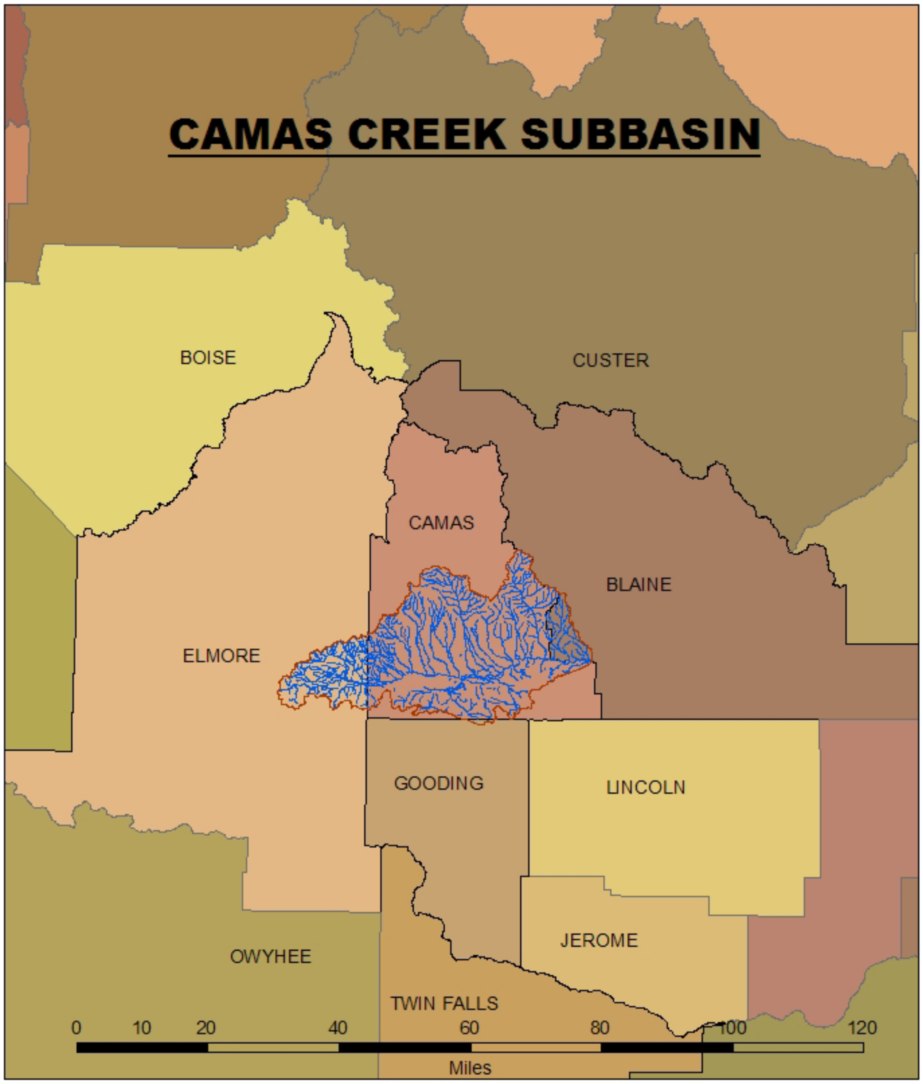


Figure 3. Camas Creek Subbasin

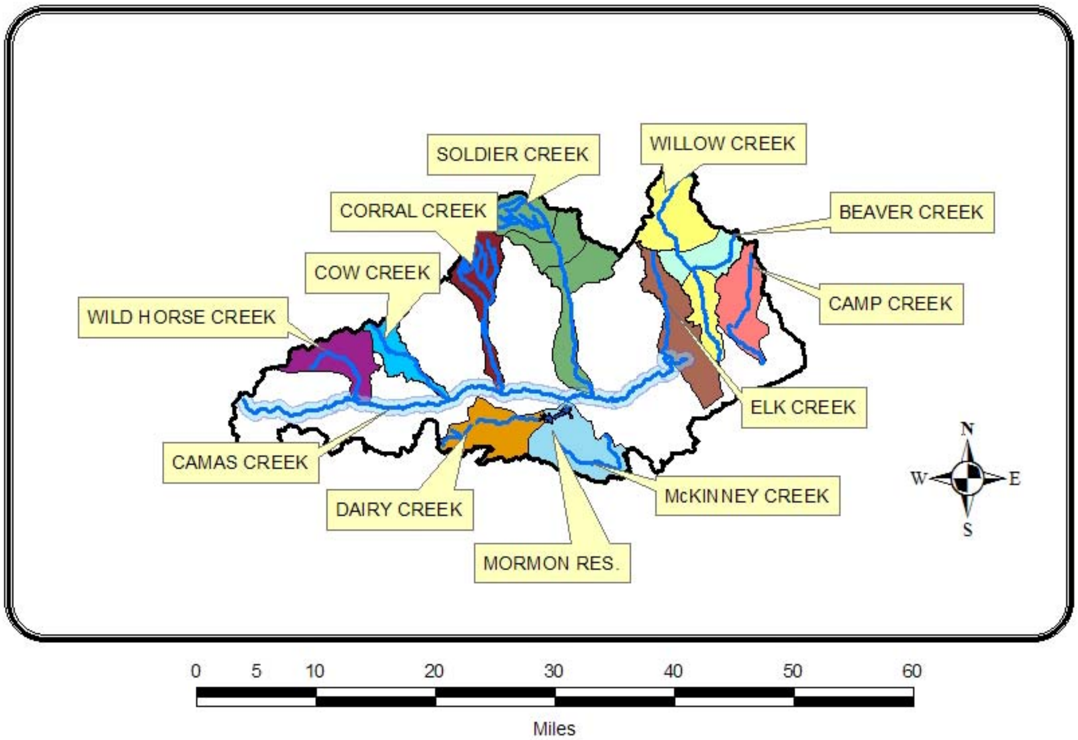


Figure 4. 303d Listed Subwatersheds in the Camas Creek Subbasin

Table 2. 5th Field HUC Subwatersheds in the Camas Creek Subbasin

5th Field HUC	HUC Name	Associated 303(d) Waterbodies	Area (km^2)	Acres	Percent of Area
17040220-01	Upper Magic Reservoir	Camp	147.9	36,546.4	8.3
17040220-02	Willow Creek	Willow, Beaver, and Little Beaver	162.7	40,181.8	9.2
17040220-03	Deer-Kelly-Elk	Elk and Camas	232.3	57,418.8	13.1
17040220-04	Soldier-Spring	Soldier and Camas	309.8	76,334.4	17.5
17040220-05	Corral Creek	Corral and Camas	89.9	22,179	5.1
17040220-06	Mormon Reservoir	McKinney and Camas	177.9	43,944.5	10.0
17040220-07	Corral-Dairy	Mormon Reservoir and Dairy Creek	176.9	43,691.9	10.0
17040220-08	Chimney-Cow	Cow and Camas	180.3	44,538.8	10.2
17040220-09	Upper Camas Creek	Camas and Wild Horse	297.3	73,491.5	16.8
Data from ArcView Coverage 1992-1996					

Landuse

Rangeland is the major land use in the Camas Creek Subbasin followed by dryland agriculture. Other uses within the subbasin include forest, water, irrigated cropland, and riparian (Table 3 and Figure 5).

Table 3. Landuse in the Camas County Subbasin

Landuse	Area (acres)	% of Subbasin
Rangeland	275,530.05	62.8
Dryland Agriculture	132,060.96	30.1
Irrigated-Sprinkler	14,034.71	3.2
Irrigated-Gravity Flow	9661.21	2.2
Riparian Land	3,508.67	.8
Forest Land	2,199.1	.5
Water	1,095.7	.3
Urban	27.5	.1

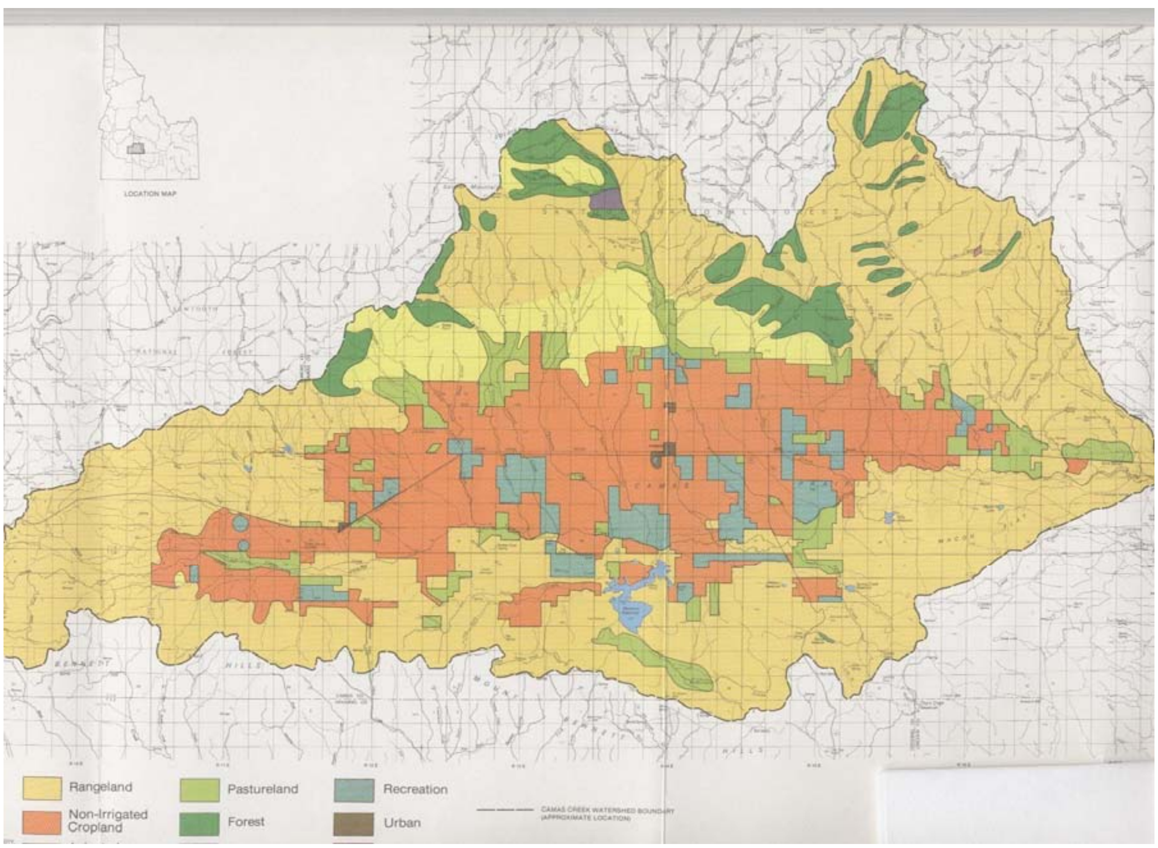


Figure 5. Landuse in the Camas County Subbasin - Camas Creek (1994)

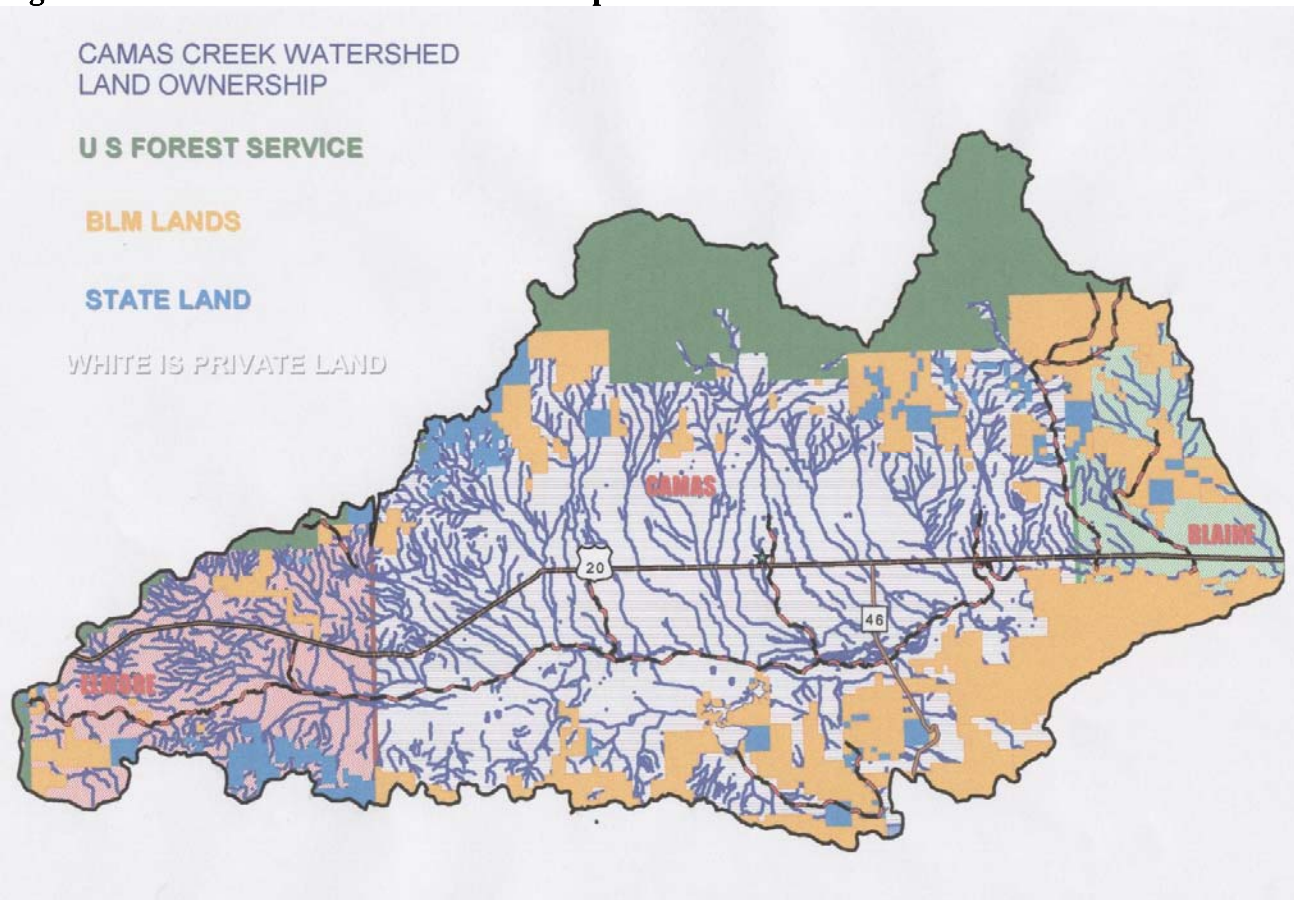
Ownership

Most of the land ownership in the Camas Creek Subbasin is private followed by public lands that are federally managed. The state also manages portions of the public land within the Subbasin (Table 4 and Figure 6) (DEQ March 4, 2005).

Table 4. Ownership in the Camas County Subbasin

Land Owner	Area (acres)	% of Subbasin
Private	278,841.06	63.7
BLM	82,429.22	18.8
USFS	54,137.41	12.4
State of Idaho	20,409.63	4.7
Open Water	2246.51	.5

Figure 6. Camas Creek Subbasin Ownership Status



Climate

The Camas Creek Subbasin can be divided into two elevation ranges. The low elevation range is equal to or less than 5,250 feet (this accounts for the valley floor and 48.1% of the subbasin area), while the high elevation range is greater than 5,250 feet (51.9% of the subbasin area) (ArcView Coverage 1992-1996). These elevation ranges are used in describing much of the climate of the subbasin. Air temperature, snowfall, and snow depth data have been collected from similar data sources and elevations. The low elevation data are an average of data from three sites within the subbasin at this elevation range. The low elevation sites include two Fairfield sites and Hill City. The high elevation data are collected from one site, Soldier Ranger Station. (IDEQ 2005).

Precipitation

The weighted mean precipitation for the Camas Creek Subbasin is 18.8 inches (WRCC 2001, NRCS 2001a). The majority of the precipitation occurs in the winter and spring months. Table 5 describes seasonal precipitation data for the two elevation ranges and Figure 7 shows the annual precipitation distribution across the subbasin.

Table 5. Average Precipitation (inches) in the Camas Creek Subbasin

Elevation	Winter Average	Spring Average	Summer Average	Fall Average	Total Annual
Upper	3.5	2.1	0.6	1.5	23.1
Lower	1.9	1.2	0.6	1.1	14.2

Data collected from Western Regional Climate Center (WRCC) and U.S. Department of Agriculture (USDA) National Resources Conservation Service (NRCS) Web sites.

Snow Depth and Snowfall

The lower elevations of the Camas Creek Subbasin receive an average total snowfall of 66 inches. The majority of this snowfall occurs from December to February, when the average snow depth for the low elevations is 13.5 inches. The majority of the snowfall in the upper elevation range occurs from January to April, when the average snow depth for the high elevations is 29.5 inches (WRCC 2001).

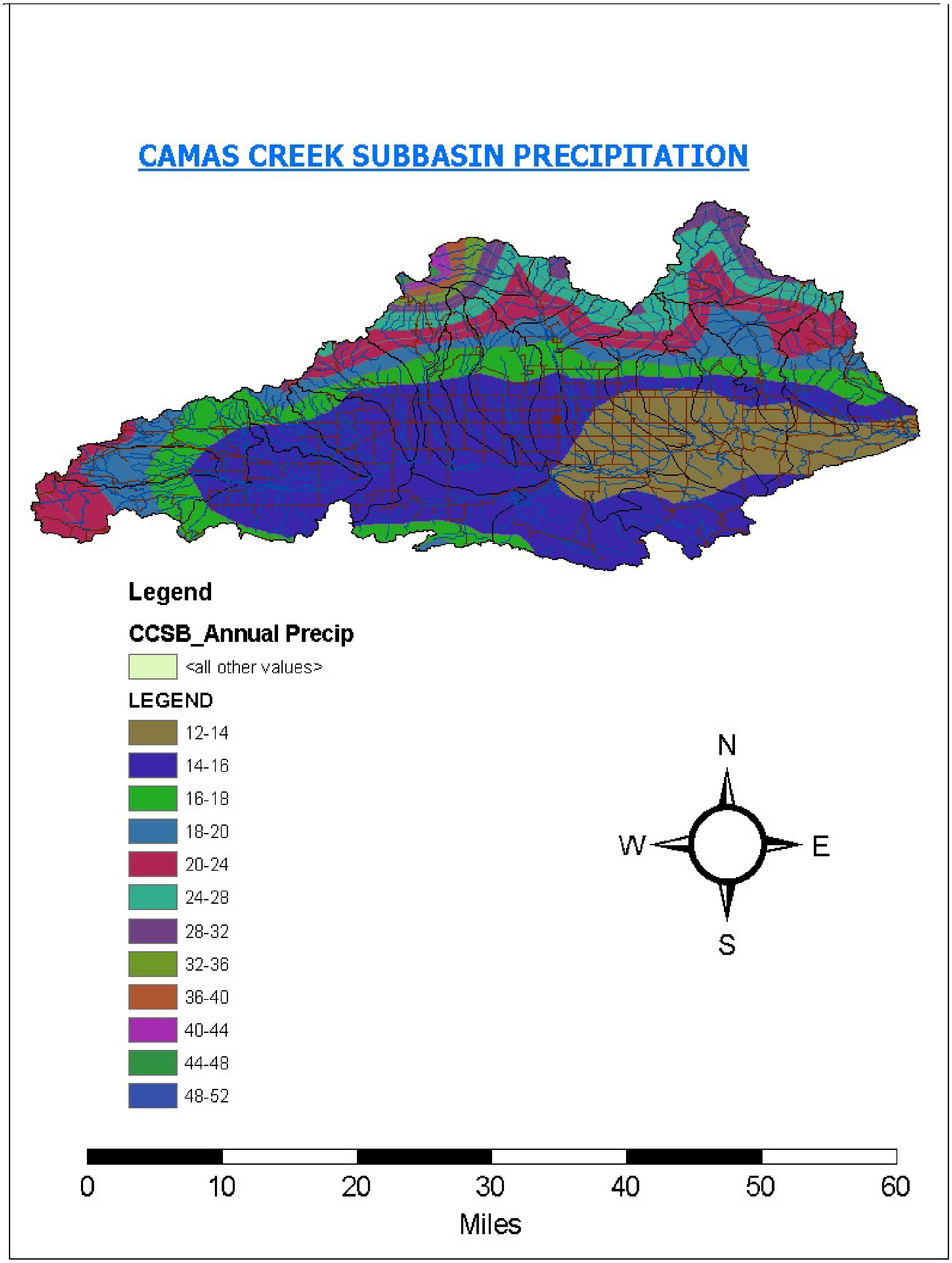


Figure 7. Camas Creek Subbasin Precipitation

Air Temperature and Available Sunlight

The highest monthly average maximums and minimums for temperature occur in the summer months, especially July. The lowest monthly average maximums and minimums for temperature occur in the winter months, most notably in January (WRCC 2001, NRCS (2001a). Table 6 describes the estimated midrange temperatures for the low and high elevations of the subbasin.

Table 6. Air Temperature and Available Sunlight

Elevation Range	Midrange Temperature (º C)	Midrange Temperature (º F)
Upper	-4.96 to 17.65	23.07 to 63.77
Lower	-8.19 to 17.78	17.25 to 64.00

Selected from Western Regional Climate Center (WRCC) and U.S. Department of Agriculture (USDA) National Resources Conservation Service (NRCS) Web sites

The estimated average annual available sunlight for this region is 12.9 hours. The greatest amount of average available light occurs in the summer months with 14.0 hours and the least amount occurs in the winter months with 10.2 hours (USNO 2001).

Evaporation and Wind Erosion

The annual evaporation for the Camas Creek Subbasin is 6 millimeters per month (mm/month), with the majority of evaporation occurring from May through September (CPC 2001). The largest amount of evaporation occurs in June and July with 20 mm/month. Wind erosion in the Camas Creek Subbasin is insignificant in its effect on water quality. Only 3.35% of the subbasin area exceeds the threshold for wind erosion (NRCS 2001b).

Subbasin Characteristics

Camas Creek, the main waterbody in the subbasin, flows through the lower elevations of the Camas Prairie. Many of the Camas Creek tributaries originate in the higher mountainous and foothill elevations; they then flow down through the flat prairie region of the subbasin before emptying into Camas Creek. The subbasin characteristics outlined below influence water resources and water quality in the subbasin.

Hydrograph

A number of natural and anthropogenic activities or conditions occur in the Camas Creek Subbasin that impact the hydrology of the subbasin such as irrigation withdrawals or seasonal dewatering of streams during the summer and fall month. Figure 8 depicts the average annual hydrograph for several of the water bodies in the subbasin (Flow data collected from 1970 to 2003). Spring runoff in the subbasin is early and rapid. The majority of the flow occurs in March and April. Less than 1 cubic foot per second (cfs) of flow occurred in July, August, September and November. (IDEQ 2006).

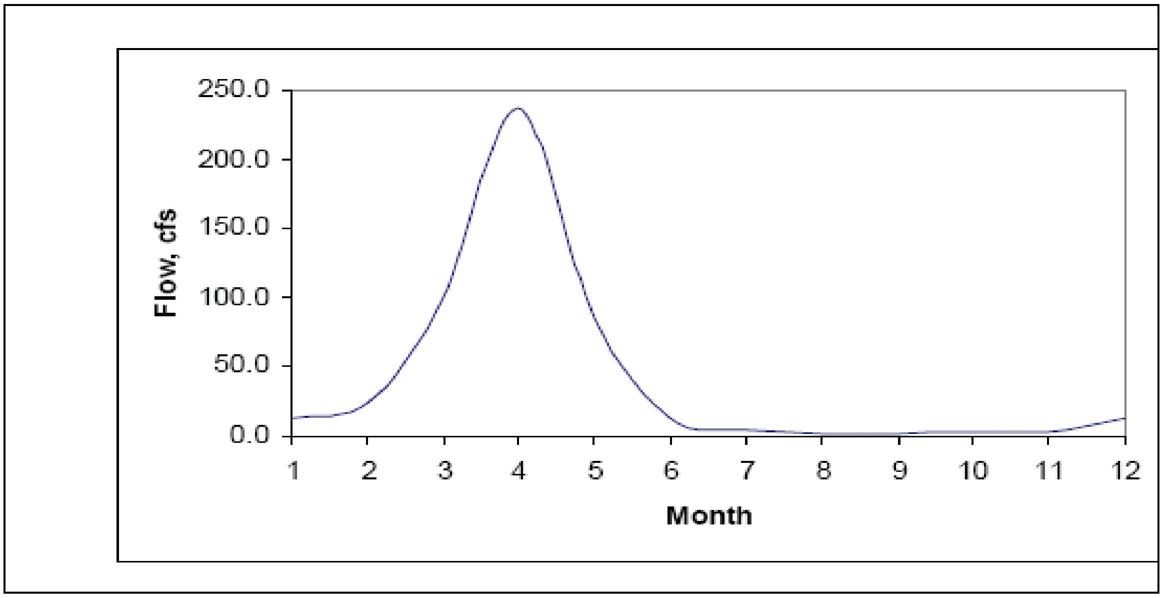


Figure 8. Camas Creek Subbasin Average Hydrograph

The hydrograph of the Camas Creek Subbasin was developed from United States Geological Survey (USGS) gauge data and flow records collected by DEQ and other agencies. The Camas Creek Subbasin has one active gauge (13141500) located on Camas Creek near the Camas County/Blaine County line.

Water Chemistry

Seasonal peaks for sediment, nutrients, and bacteria occur in the Camas Creek Subbasin. Historical and recent data were used to determine peak discharge of pollutants in the subbasin.

Suspended load constitutes both washload and suspended bed-material load. Washload comes from the banks and upland areas and can remain in suspension during low velocities. Suspended bed-material load is transported with the washload by turbulent water and will drop out when velocities decrease (Gordon et al., 1992). Sediment in the subbasin was measured in the form of total suspended solids (TSS).

There are two peak discharges of TSS. The first peak occurs during the spring runoff and the second peak occurs in the fall during base flow events. The spring peak is expected during spring runoff when flows are higher and more washload and suspended bed-material are being transported. The fall peak is unexpected because it occurs at a time when stream velocities are typically low and less likely to be carrying suspended bed-material loads. The fall peak is likely due to anthropogenic activities occurring in the subbasin, although late season precipitation events could also contribute to sediment loads during base flow events.

Ground Water

The volcanic setting of the Camas Prairie influences the average temperatures of ground water which average 10ºC above mean annual temperatures. These thermal waters directly affect stream temperatures resulting in some non-compliance with cold water biota requirements. Measured surface temperatures range from 26ºC to 72ºC and averaged 53ºC. Thermal water occurrences are not limited to any one locality or rock type and are sparsely distributed over a large area, more abundant to the west and less abundant to the east with only slightly higher water temperatures (IDWR 1979).

For specific information on geothermal influences in the Camas Creek Subbasin see Appendix 1, Geothermal Influence on Water Temperature

Geology

The Camas Creek Subbasin is dominated by volcanic rock types surrounding a central valley fill of sand and gravel surfaced in a large extent by lacustrine sediments. The basin is bordered on the north by the granitic Soldier Mountains and defined on the south margin by the Bennett Hills escarpment. Dominant rock types in the Camas Creek Subbasin are shown in Figure 9.

There are 10 different rock types in the Camas Creek Subbasin. The central portion consists of Quatenary alluvium (valley fill deposits) and basalt outcroppings (continental deposits). The northern region consists mostly of Cretaceous granitic plutons of the Idaho Batholith and Tertiary volcanic rocks (igneous extrusives). The southern region consists mainly of Tertiary volcanic rocks and Quatenary basalt of the Bruneau Formation with limited small outcroppings of Idaho Batholith granite.

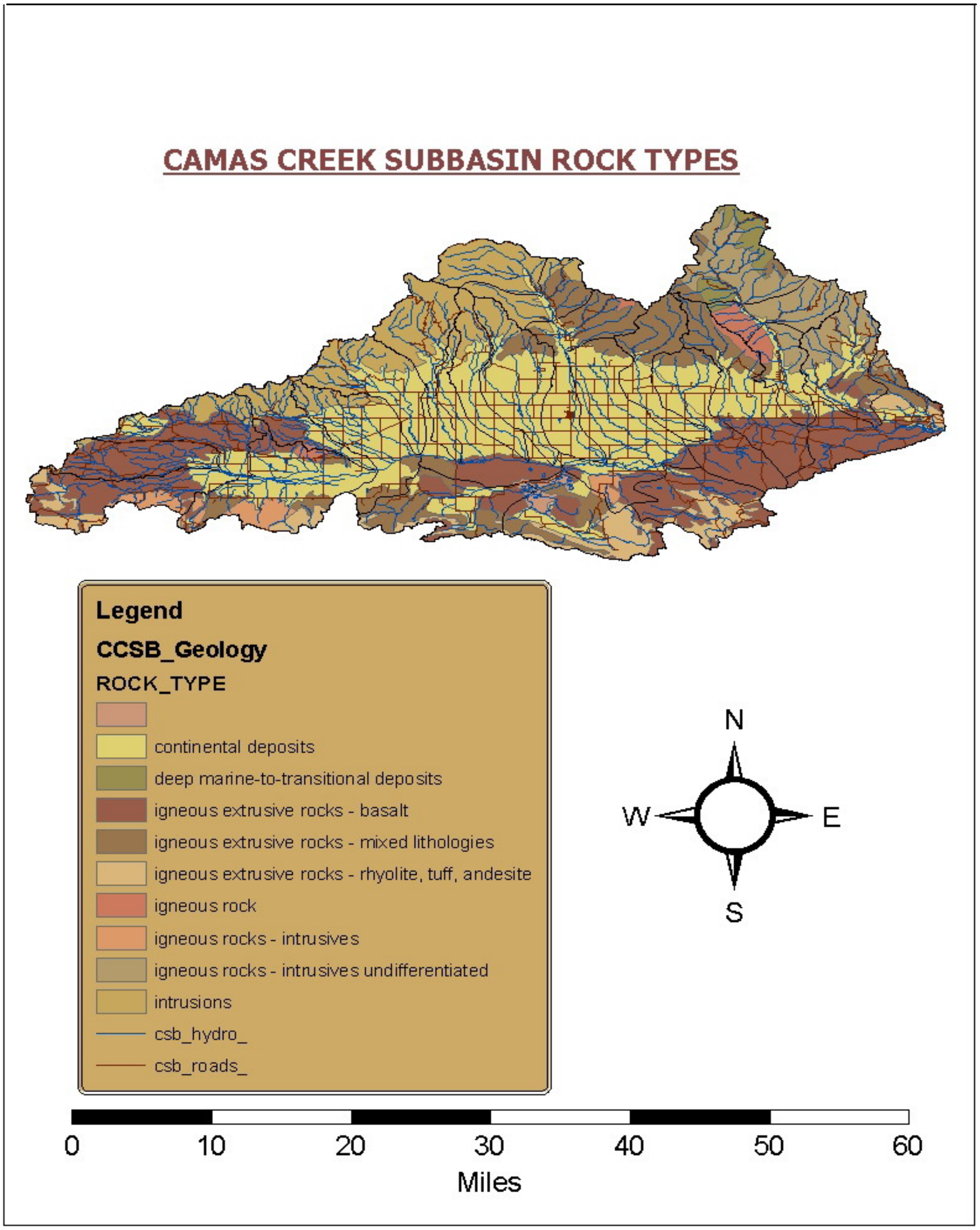


Figure 9. Camas Creek Subbasin Rock Types

Accomplishments

In the past, multiple Districts and agencies including the Idaho Soil Conservation Commission, the Idaho Association of Soil Conservation Districts, the Natural Resources Conservation Service, the Resource Conservation and Development, the Department of Environmental Quality, and the Watershed Advisory Groups have worked together in the Camas Creek Subbasin to initiate, fund, install and evaluate many and varied conservation projects.

Camas Creek Subbasin Pollution Control Efforts Summary

The Camas Soil Conservation District was officially organized August 23, 1957. Since then, the District has been very active in working to enhance and preserve natural resources within the Camas Creek Subbasin. In 1982, the District completed a project to stop streambank erosion along the West Fork of Corral Creek and conducted a preliminary study of erosion along the West Fork of Three Mile Creek. The District also completed a comprehensive study of stream channel erosion in all major streams within the Camas Creek Subbasin. Other accomplishments in the subbasin are summarized in Table 7.

In June of 1994, the District completed the Camas Creek Agricultural Pollution Abatement Plan funded under Idaho's State Agricultural Water Quality Program (SAWQP), the predecessor of the state's current Water Quality Program for Agriculture (WQPA). In February 1996, the District signed a SAWQP grant agreement for $580,770 for implementation of BMPs within the Soldier Creek subwatershed. As a result of this effort, fifteen individual contracts were developed and implemented treating 9,459 critical acres. BMPs in the subbasin installed with assistance from the SAWQP/WQPA program are listed in Table 8.

Table 7. Camas Creek Subbasin Pollution Control Efforts

Group/Program	Activity
Beaver Management Committee	Relocation of beavers for stream restoration.
Willow Creek Project	Riparian areas fenced off from grazing, planting of native species, streambank stabilization, and water quality monitoring.
Camas Soil Conservation District	55 Conservation Reserve Program contracts on 7,509.7 acres
Individuals	Stream Channel Alteration Permits—Soldier Creek: four streambank stabilization projects; Willow Creek: one stabilization project and two culver/bridge projects, Camas Creek: two streambank stabilization projects and one bridge replacement project.
Elmore County Soil Conservation District	Conservation Reserve Program contracts, bank stabilization, and riparian plantings.

BMPs Installed—State Water Quality Program for Agriculture (WQPA)

Table 8. WQPA—BMP Expenditures to Date in the Camas Creek Subbasin

Best Management Practice:	Amount Installed:	Total BMP Costs:	Operator Funds:	State Matching:	Other Monies:	Acres Treated:	Units Counted Acres	Riparian Feet	AFO (Head)
BRUSH MANAGEMENT	165 AC	$2,460	$1,448	$1,012	$0	165	165	0	0
DAM, DIVERSION	0.66 EA	$44,592	$24,592	$20,000	$0	0	0	0	0
DIKE	944 FT	$3,185	$1,983	$1,202	$0	0	0	0	
FENCE	63479 FT	$86,938	$52,629	$34,309	$0	4,423	3,711	16,863	0
GRADE STABILIZATION STRUCTURE	25 EA	$19,371	$5,728	$13,644	$0	22	22	0	0
HEAVY USE AREA PROTECTION	6 EA	$7,500	$1,875	$5,625	$0	0	0	0	
PASTURE & HAYLAND PLANTING	162.8 AC	$7,987	$1,364	$6,623	$0	163	0	0	0
PRESCRIBED GRAZING	571.6 Ac	$3,428	$3,428	$0	571	143	0	0	
SPRING DEVELOPMENT	12 EA	$29,910	$17,201	$12,709	$0	518	0	0	0
STREAM CHANNEL STABILIZATION	3 EA	$975	$244	$731	$0	0	0	0	
STREAMBANK & SHORELINE PROTECTION	8 EA	$3,685	$921	$2,764	$0	5	5	0	0
STREAMBANK & SHORELINE PROTECTION	2187 FT	$10,996	$3,069	$7,927	$0	7	7	220	0
STRUCTURE FOR WATER CONTROL	3 EA	$29,422	$20,929	$8,493	$0	0	0	0	
Project Total:		**$250,449**	**$135,411**	**$115,038**	**$0**	**5,874**	**4,052**	**17,083**	**0**

(A Total of 13 BMPs Recorded) Overall Summary of Best Management Practices

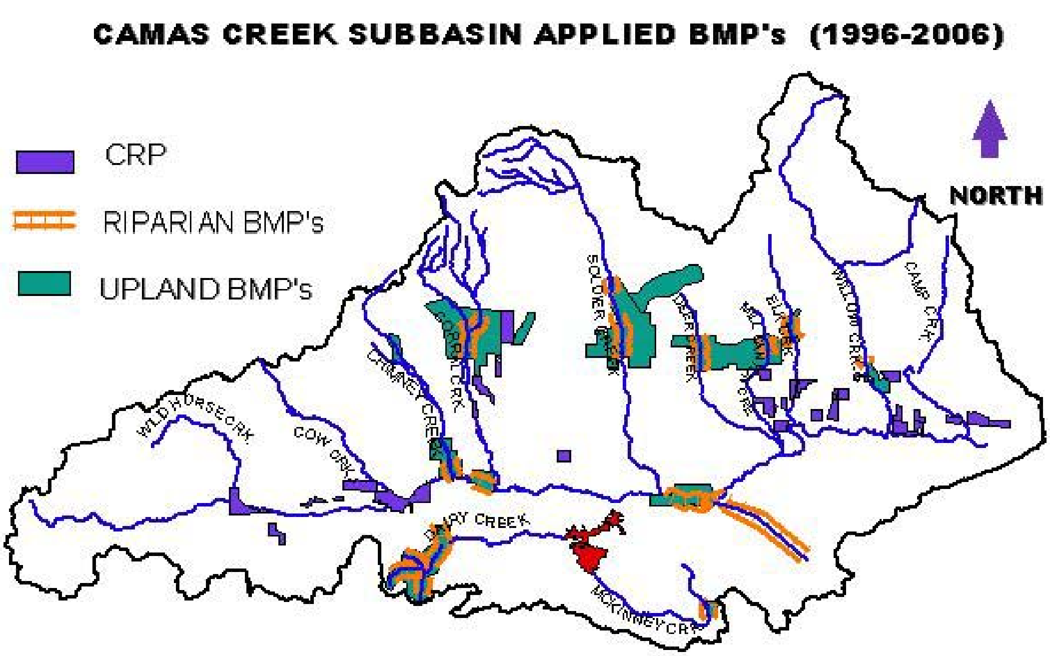
BMPs Installed—Natural Resources Conservation Service (NRCS)

Table 9 shows BMPs implemented and funding provided ($397,169.63) over the last eight years (1999-2006) by NRCS Programs. Additionally, approximately $595,754.00 in matching funds were provided by landowners participating in these NRCS programs.

Table 9. NRCS—BMP expenditures to date in the Camas Creek Subbasin

Practice No.	Practice	Units	Amount
348	Dam/Diversion	1 ea	$18,708.00
442	Irrigation System Sprinkler	200 Ac.	$50,000.00
512	Pasture & Hayland Planting	86.2 Ac.	$36,694.75
516	Pipeline	2,800 ft.	$2,625.00
574	Spring Development	1 ea.	$223.00
580	Streambank & Shoreline Protection	228 ft.	$2,008.00
614	Watering Facility	1 ea.	$375.00
657	Wetland Restoration	18 Ac.	$46,111.88
391	Riparian Forest Buffer	733.4 Ac.	$201,021.00
SWCA	Practices Reported In Tracker Summary		$39,403.00
TOTALS			**$397,169.63**

Figure 10. Camas Creek Subbasin Applied BMP'S (1996 – 2006) From All Funding Sources



Water Quality Monitoring

The Idaho Association of Soil Conservation Districts (IASCD) began monitoring Camas Creek in April 2005 at the request of the Camas Soil Conservation District. Camas Creek was monitored to determine BMP effectiveness on approximately four miles of stream bordering land enrolled in the NRCS's Conservation Reserve Program.

Water Chemistry Monitoring Results

Water quality samples were collected using a depth integrated sampler when the depth of water was greater than one foot. At lesser depths, a grab sample was taken. Samples were analyzed for nitrogen, total phosphorus, orthophosphates, suspended solids, fecal coliform bacteria and E. coli bacteria. Measurements of dissolved oxygen, specific conductance, pH, temperature and total dissolved solids were also taken at each monitoring location. Results from this monitoring effort are summarized in Tables 10 and 11.

Table 10. Water Quality Monitoring Results—Camas Creek 2006

Site	Description	Mean Discharge (cfs)	Mean TP (mg/L)	TP Load (lbs/day)	Mean TSS (mg/L)	TSS Load (lbs/day)
CC1	Camas Creek at Mormon Reservoir bridge	9.32	0.06	3.02	3.9	130.54
CC2	Camas Creek 1/4 mile above Highway 46 bridge	11.39	0.06	3.68	6.5	398.83
TP = total phosphorous; TSS = total suspended solids						

Average stream discharge at CC1 was 9.32 cfs and 11.39 cfs at CC2. Stream discharge from Soldier creek was not sampled during this study. Peak discharge occurred in April with a maximum flow of 151 cfs at CC2 and 130.19 cfs at CC1 (Clawson, J.).

Soldier Creek and local runoff are the only contributing waters into Camas Creek between sites CC1 and CC2; therefore, it may be inferred that the difference in parameters is attributable to the input of Soldier Creek and local waters. Soldier Creek has an average TP of 0.026 (IDEQ 2005). Since there is no increase in TP between sites CC1 and CC2 it is reasonable to assume that the BMPs in place along this four mile reach of Camas Creek are effective at removing 0.026 mg/L of TP.

TSS averaged 3.9 mg/L at CC1 and 6.5 mg/L at CC2. Neither site had an exceedance of 13 mg/L, well below the monthly target of 50 mg/L, during the sample period; however, TSS loads did increase downstream by 67%. The TMDL lists sediment impacts, which increase TSS, in the form of bedload sediment and streambank erosion (Clawson J.).

Bedload Monitoring Results

Bedload measurements were conducted at the established Camas Creek monitoring stations in 2006 from May 18th when Camas Creek flood stage waters decreased to bankfull until July 7th when water levels fell below four inches in depth, the height necessary for a bedload sampler to accurately measure bedload. Bedload for Soldier Creek was not measured during this study.

Bedload monitoring results on Camas Creek show a decrease of 25% between sites CC1 (Mormon Reservoir Bridge) and CC2 (Highway 46 Bridge). Soldier Creek's existing load is measured at 772.2 tons/year (DEQ 2005). Since there is no increase in bedload between CC1 and CC2, in fact there is a decrease, it may reasonably be assumed that the bedload of Soldier Creek plus the 25% reduction in Camas Creek between these two points is captured within the conservation reserve riparian area.

Figure 11. Camas Creek Bedload

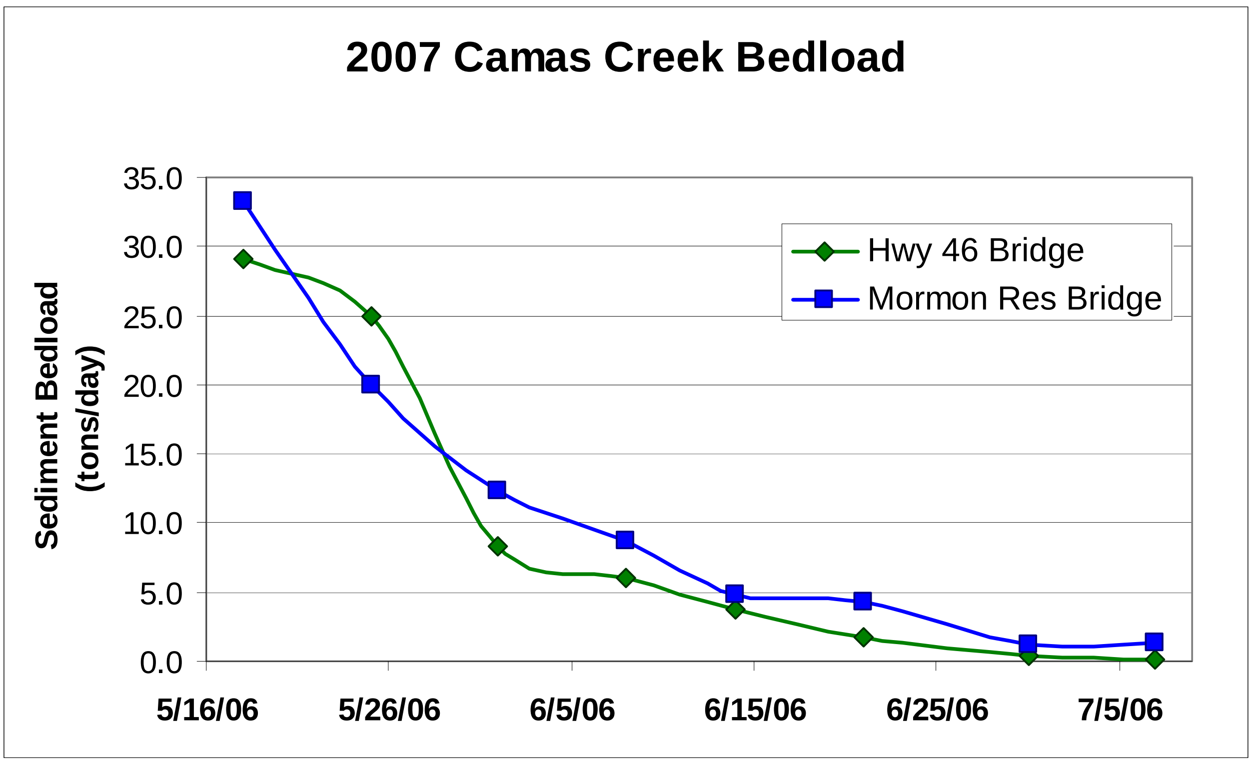


Table 11. Camas Creek Bedload Survey Results 2006

Date	Site	Flow	USGS Flow	Temp °C	Cond (microS)	DO mg/L	pH	Weight (grams)	Weight x Total Width per minute (grams/min)	Tons/ day	Total Tons	# Stations	Station Width (feet)	Flow* Day/ Tons
Hwy 46 (CC2)														
04-May-06	Hwy 46	736	1375											
18-May-06	Hwy 46	560	960					1525.6	18,307	**29.1**	**189.2**	12	6	19
25-May-06	Hwy 46	475	950		98.5			1312.6	15,751	**25.0**	**116.5**	11	6	19
01-Jun-06	Hwy 46	159	450					434.7	5,216	**8.3**	**50.1**	11	6	19
08-Jun-06	Hwy 46	167	350	17.9	96	5.5	6.8	317.4	3,809	**6.0**	**34.2**	11	6	28
14-Jun-06	Hwy 46	133	320	14.4	119	6.7	6.6	195.5	2,346	**3.7**	**16.4**	11	6	36
21-Jun-06	Hwy 46	111	160	16.2	130	7.0	6.7	91.0	1,092	**1.7**	**7.3**	9	6	64
30-Jun-06	Hwy 46	19	65	20.0	122	5.1	6.7	18.1	217	**0.3**	**2.1**	8	6	56
07-Jul-06	Hwy 46	13	42	19.9	130	4.3	6.8	6.3	76	**0.1**	**0.8**	8	6	112
									Total Tons (May 18 - July 7)		**416.6**			
Mormon Reservoir (CC1)														
18-May-06	Mormon Res	315						2621.3	20,970	**33.3**	**186.6**	10	4	9
25-May-06	Mormon Res	216			110			1578.1	12,625	**20.0**	**113.2**	10	4	11
01-Jun-06	Mormon Res	97						968.9	7,751	**12.3**	**73.7**	10	4	8
08-Jun-06	Mormon Res	65		20.1	135	6.8	7.3	688.2	5,506	**8.7**	**47.5**	10	4	7
14-Jun-06	Mormon Res	64		15.3	149	7.1	7.0	381.1	3,049	**4.8**	**27.6**	10	4	13
21-Jun-06	Mormon Res	27		17.7	132	8.1	7.0	342.7	2,742	**4.4**	**19.2**	10	4	6
30-Jun-06	Mormon Res	10		22.5	181	10.2	8.4	90.2	722	**1.1**	**11.4**	10	4	9
07-Jul-06	Mormon Res	8		22.1	167	9.2	7.7	109.20	874	**1.4**	**9.7**	5	4	6
									Total Tons (May 18 - July 7)		**488.9**			

Agricultural Water Quality Inventory & Evaluation

Riparian Assessment

Over 96 miles of Camas Creek and its tributaries were assessed during the 2005 and 2006 season by teams assembled from personnel of the Idaho Association of Soil Conservation Districts, the Idaho Soil Conservation Commission, and the Natural Resources Conservation Service. The teams evaluated direct and indirect impacts to the streams and their riparian areas. The data from these evaluations were used to develop realistic goals for TMDL watershed improvement and the designation of critical areas and treatment units.

Riparian Assessment Methods

The assessment teams used NRCS Technical Note ID-67; IDEQ Protocol # 8; and NRCS Technical Note ID-29 (SVAP) to evaluate riparian condition. The streams were divided into assessment reaches using soils, geology, slope, sinuosity, vegetation, hydrology, roads, drainage area, valley type, and land use. Elevations, slopes, stream order, and sinuosity were estimated from USGS 7.5’ maps.

<u>NRCS Tech Note ID-67</u>

NRCS Riparian Appraisal and Aquatic Habitat Evaluation--Range Technical Note ID-67 is an evaluation system to determine the condition of the riparian zone and help develop management alternatives (NRCS, 1995).

<u>IDHW-DEQ Protocol # 8</u>

IDHW-DEQ Protocols for Classifying, Monitoring, and Evaluating Stream/Riparian Vegetation on Idaho Rangeland and Streams—Protocol #8 describes the levels of data required for implementing the Idaho Antidegradation Policy; basic reconnaissance, and intensive (IDHW, 1992). The monitoring strategy requires stratifying the stream into sub-areas based upon natural features, land use, and sampling recommendations. This protocol included: stream classification, green line, Solar Pathfinder, streambank stability, photo points, and channel cross sections.

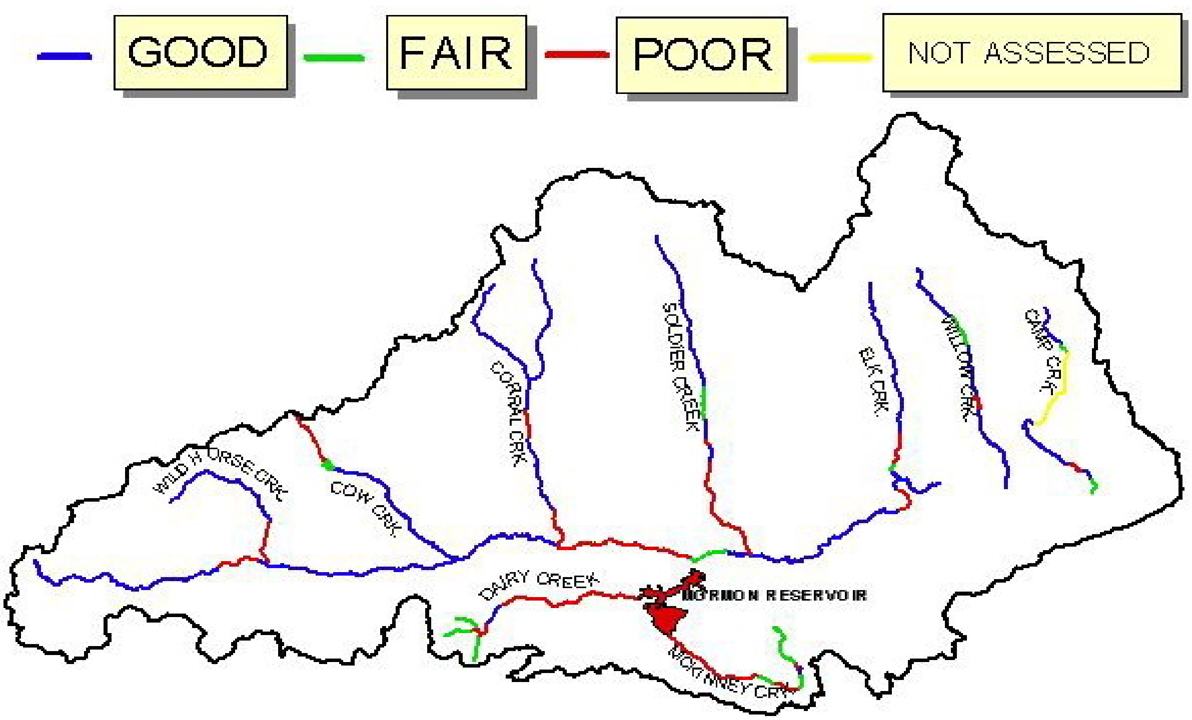
<u>NRCS Tech Note ID-29 (SVAP)</u>

The Stream Visual Assessment Protocol (SVAP) provides procedure to evaluate stream conditions based on visual characteristics. SVAP includes 15 qualitative factors and corresponding numeric values, which are averaged to rate the reach’s condition. Eleven ranking factors are required with three factors ranked when applicable. The protocol assesses riparian ecosystems conditions; identifies opportunities to enhance biological value; conveys information on stream function; and stresses the need to protect or to restore riparian areas (NWCC, 1998). Currently, NRCS uses SVAP to assess aquatic habitat and recommends a “fair” rating as a minimum goal for conservation planning (NRCS), 2004).

Riparian Assessment Results

Data collected using the above assessment methods were used to establish a rating of Good, Fair, or Poor for the impaired stream reaches. Results are shown in Figure 12. Beaver Creek and Little Beaver Creek are within the boundaries of the Sawtooth National Forest and therefore were not assessed with the streams on private agricultural lands. Mormon Reservoir was not assessed as it is assumed to be impaired as long as the streams supplying the reservoir are impaired.

Figure 12. Camas Creek Subbasin Water Quality Assessed Reaches



Upland Assessment

Upland assessments were developed from information compiled from: the Idaho Cooperative River Basin Study – Camas Creek Watershed for Channel Erosion and Sedimentation Problems (USDA, ISCC, USFS, and the Camas Soil Conservation District, May 1987); the Agricultural Pollution Abatement Plan – Camas County, Idaho (USDA, ISCC, Idaho Department of Health and Welfare – Division of Environmental Quality, June 1994); the Soil Survey of Camas County Area Idaho (USDA- Soil Conservation Service, USDA-Science and Education Administration, the Bureau of Land Management and the University of Idaho College of Agriculture-Idaho Agricultural Experiment Station, May 1981); the Camas Soil Conservation District (2001-2006); and personal communications regarding landuse history, soils, climatic considerations, and cultural impacts.

Upland Assessment Results

Upland resource problems influencing water quality in the subbasin include sediment transport to surface waters from steep rangelands and modified watershed hydrology due to declining range conditions. Impacts from rangeland also include destabilized riparian areas as a result of increased runoff from rangelands (Camas Creek Agricultural Abatement Plan, June 1994).

Problem Identification

Designated Beneficial Uses

Idaho water quality standards require that beneficial uses of all water bodies be protected. Beneficial uses include existing uses, designated uses, and presumed existing uses. Designated uses are uses officially recognized by the state. In cases where designated uses have not been established by the state for a given water body, DEQ has established the presumed existing uses of supporting cold water aquatic life and either primary or secondary contact recreation. Beneficial uses for water bodies on the 303(d) list in the Camas Creek Subbasin are listed below in Tables 12 and 13.

Table 12. Camas Creek Subbasin Designated Beneficial Uses

Water body	Designated Uses[a]	1998 §303(d) List[b]
Camas Creek – Headwaters to R10E T2S NW/SE/NW	CW, SS, PCR	X
Camas Creek – R10E T2S NW/SE/NW to Hall Gulch Creek	CW, SS, PCR	X
Camas Creek – Hall Gulch Creek to Cow Creek	CW, SS, PCR	X
Camas Creek – Cow Creek to Soldier Creek	CW, SS, PCR	X
Camas Creek – Soldier Creek to Macon Flat Bridge	CW, SS, PCR	X
Camas Creek – Macon Flat Bridge to Magic Reservoir	CW, SS, PCR	

a--CW – Cold Water, SS – Salmonid Spawning, PCR – Primary Contact Recreation,
b--This list is required under section 303, subsection “d,” of the Clean Water Act.
(DEQ 2005).

Table 13. Camas Creek Subbasin Existing/Presumed Uses

Water body	Existing/Presumed Uses [a]	1998 §303(d) List[b]
Wild Horse Creek	CW, SCR	X
Cow Creek	CW, SCR	X
Corral Creek	CW, SS, SCR	X
McKinney Creek	CW, SCR	X
Soldier Creek	CW, SS, PCR	X
Elk Creek	CW, SCR	X
Willow Creek	CW, SS, PCR	X
Beaver Creek	CW, SS, SCR	X
Little Beaver Creek	CW, SS, SCR	X
Camp Creek	CW, SS, SCR	X
Dairy Creek	CW, SCR	
Mormon Reservoir	CW, PCR	X

a--CW – Cold Water, SS – Salmonid Spawning, PCR – Primary Contact Recreation, SCR – Secondary Contact Recreation
b--Refers to a list created in 1998 of water bodies in Idaho that did not fully support at least one beneficial use.
(DEQ 2005)

Beneficial Use Status

The beneficial uses for Camas Creek and its tributaries are:

Cold Water Biota
Salmonid Spawning
Primary Contact Recreation
Secondary Assessment Contact Recreation

Camas Creek and its tributaries are not fully supporting beneficial uses due to exceedance of one or more water quality standards (Table 3 on page xxiv of the Camas Creek Subbasin Assessment and TMDL).

Pollutants

There are 12 water quality limited segments in the 1998 303(d) list that occur in the Camas Creek Subbasin (Table 14 and Figure 13). In general, the tributaries to Camas Creek are listed in the prairie region of the subbasin and in regions owned by private landowners; however, TMDLs completed will encompass the entire stretch of the water body.

In general, water quality impairment in the subbasin is due to: channel incisement; streambank erosion; lowered water tables; sheet, rill and gully erosion; flooding and sediment deposition. These conditions are indicators of unstable stream channels and overall poor hydrologic conditions within the various land uses in the subbasin (Camas Creek Pollution Abatement Plan, 1994).

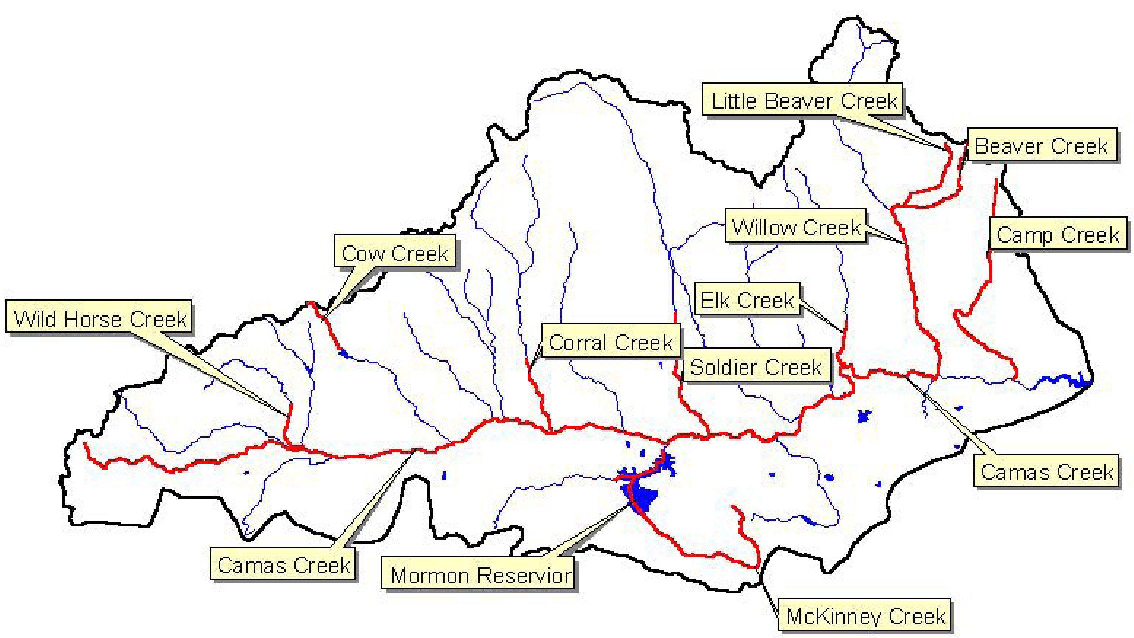


Figure 13. Camas Creek Subbasin 1998 Listed Waterbodies

Table 14. Impaired Waters of the Camas Creek Subbasin

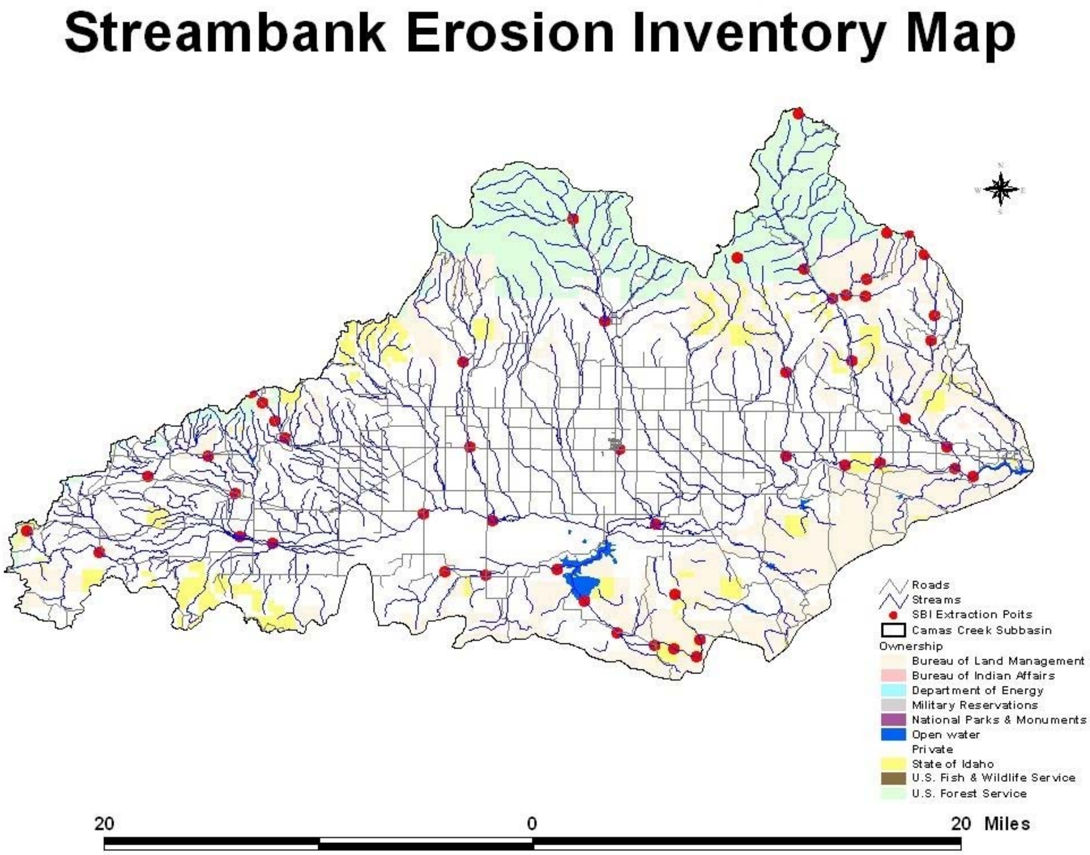
Water body Name	Assessment Unit	1998 §303(d) Boundaries	Pollutants
Camas Creek	ID17040220SK013_05 ID17040220SK001_05 ID17040220SK007_05 ID17040220SK018_04 ID17040220SK018_03 ID17040220SK018_02	Headwaters to Macon Flat Bridge	SEDIMENT TEMPERATURE NUTRIMENT
Soldier Creek	ID17040220SK011_02	Baseline to Camas Creek	SEDIMENT TEMPERATURE
Mormon Reservoir	ID17040220SK023L_0L	Reservoir	SEDIMENT NUTRIENTS
Little Beaver Creek	ID17040220SK004_02	Headwaters to Beaver Creek	TEMPERATURE
Camp Creek	ID17040220SK002_02 ID17040220SK002_03	Headwater to Camas Creek	SEDIMENT TEMPERATURE
Willow Creek	ID17040220SK003_04	Beaver Creek to Camas Creek	TEMPERATURE
Elk Creek	ID17040220SK006_02	Baseline Road to Camas Creek	SEDIMENT
McKinney Creek	ID17040220SK025_02	Headwaters to Mormon Reservoir	SEDIMENT
Corral Creek	ID17040220SK015_03	Highway 20 to Camas Creek	SEDIMENT TEMPERATURE
Cow Creek	ID17040220SK018_02	Headwaters to Cow Creek reservoir	SEDIMENT NUTRIENTS
Wild Horse Creek	ID17040220SK021_03	Highway 20 to Camas Creek	SEDIMENT BACTERIA TEMPERATURE
Beaver Creek	ID17040220SK004_02	Headwaters to Willow Creek	TEMPERATURE
Dairy Creek	ID17040220SK024-02	Headwaters to Mormon reservoir	SEDIMENT NUTRIENT

Table 15. Load Reductions Required on the Impaired Waters of the Camas Creek Subbasin

Waterbody	Pollutant	Critical Flow (cfs)	Target	Load Capacity	Existing Load	Percent Reduction
SOLDIER	SEDIMENT	67.40	80.00	99,20	772.20	87.20
	TEMPERATURE	36.00	55-30	702,970.00	866,896.90	18.90
WILLOW	TEMPERATURE	46.10	55-30-55	520,872.90	549,718.20	5.20
BEAVER	TEMPERATURE	8.10	85-60	33,946.00	74,828.00	54.60
CAMP	SEDIMENT	7.30	80.00	89.40	278.30	67.90
ELK	SEDIMENT	5.00	80.00	63.60	142.10	55.20
CORRAL	SEDIMENT	42.40	80.00	35.80	121.50	70.50
	TEMPERATURE	20.40	50.00	201,544.20	322,974.60	37.60
COW	SEDIMENT	7.80	80.00	15.50	81.50	81.00
	NUTRIENTS	6.40	0.05	1.72	4.00	56.50
WILD HORSE	SEDIMENT	4.90	80.00	18.30	46.50	60.60
	BACTERIA	1.50	576.00	576.00	2,500.00	77.00
	TEMPERATURE	2.30	50.00	169,873.00	283,983.30	40.20
McKINNEY	SEDIMENT	2.50	80.00	72.40	646.60	88.00
DAIRY	SEDIMENT	7.40	80.00	5,220.00	1,677.20	96.90
	NUTRIENTS	6.00	0.05	1.62	2.75	41.20
CAMAS	SEDIMENT	543.00	80.00	512.60	8,018.80	96.60
	NUTRIENTS	228.40	0.05	61.55	130.49	52.80
	TEMPERATURE	247.60	30-30-18-15-15	4,370,044.40	4,822,992.40	9.40
SEDIMENT TARGET MEASURED IN PERCENT BANK STABILITY, LOAD CAPACITY AND EXISTING LOAD MEASURED IN TONS/YEAR, TEMPERATURE TARGET MEASURED IN PERCENT CANOPY COVER, LOAD CAPACITY AND EXISTING LOAD MEASURED IN (KWH/DAY), NUTRIENTS TARGET MEASURED IN MG/L, LOAD CAPACITY AND EXISTING LOAD MEASURED IN (LBS/DAY)						

Streambank erosion inventories were completed by DEQ for each creek in the subbasin that had a sediment TMDL completed. Figure 14 below shows the segment breaks and the location of erosion monitoring points for these streambank erosion inventories.

Figure 14. Streambank Erosion Inventory Map



Threatened or Endangered Species

No listed threatened or endangered species are identified in the Camas Creek Subbasin by the U.S. Fish and Wildlife Service. Three candidates and two sensitive species are identified as occurring in the Camas Creek Subbasin and are listed below.

Bugleg Goldenweed (candidate) (*Haplopappus incestircrucis*)
Long-billed Curlew (candidate) (*Numenius americanus*)
Owyhee Sagebrush (candidate) (*Artemisia papposa*)
Small flowered Gymnosteris (BLM sensitive) (*Gymnosteris parvula*)
Owyhee Morning Milk-Vetch (Monitor—sensitive) (*Astragalus atratus var owyheensis*)

When the above listed species are found on agricultural lands, conservation planning will be coordinated with other species recovery and protection efforts in the subbasin to improve the candidate and sensitive species' habitats and address any potential impacts to these species from agricultural BMP implementation. Improvements in water quality, achieved from BMPs installed on agricultural lands are not expected to adversely affect any of the species listed above.

Implementation Priority (rationale)

Critical Areas

Critical acres are those having the most significant impact on the quality of the receiving waters. These critical acres include pollutant source and transport areas. Private agricultural land accounts for 139,122 acres in the Camas Creek Subbasin and private rangeland accounts for 275,276 acres. The critical areas considered in this TMDL implementation plan are areas of agricultural lands which are both providing the most significant negative impact on the water quality of the receiving waters within the watershed and areas where BMP implementation could realistically be accomplished. Critical areas are further delineated by treatment units. Information from IACSD staff field observations, water quality monitoring data, and agricultural water quality inventories and evaluations were used in the delineation of critical areas and treatment units.

Recommended Priorities for BMP Implementation

Critical areas are prioritized for treatment based on their proximity to a water body of concern and their potential for pollutant transport and delivery to the receiving water body. The Camas Soil Conservation District determined the critical area priorities with emphasis given to resource problems on upstream and unstable streambanks. Priority is therefore given to areas of unstable streambanks with the alluvial fans of each stream ranked highest, the valley floor ranked second priority, and the forested uplands ranked third priority.

Treatment

Proposed Treatment Units (TUs)

The following Treatment Units (TUs) (Tables 16 and 17) describe areas with similar land uses, productivity, resource concerns, and treatment needs. These TUs not only provide a method for delineating and describing land use, but are also used to evaluate land use impacts to water quality and in the formulation of alternatives for solving problems.

Table 16. Proposed Treatment Units for Agricultural Lands in the Camas Creek Subbasin

TREATMENT UNIT 1	TU 1	IRRIGATED AND NON-IRRIGATED CROPLAND
TREATMENT UNIT 2	TU 2	IRRGATED AND NON-IRRIGATED PASTURE
TREATMENT UNIT 3	TU 3	RIPARIAN CORRIDOR
TREATMENT UNIT 4	TU 4	RANGELAND
TREATMENT UNIT 5	TU 5	ANIMAL FACILITIES

Treatment Unit #1--Irrigated and non-irrigated cropland

Average precipitation is 16 inches; 80 frost free days
Mostly sprinkler irrigated crops of alfalfa and small grains

Acres	Soils	Resource Problems
4,124	Mostly Simonton and Brinegar soils on nearly level to gently sloping low terraces and alluvial fans. Soils are very deep and well to moderately well drained. Surface layers are predominantly loams. Available water capacity is high and very high.	Sheet, rill, concentrated flow erosion and soil compaction is caused by excess tillage and lack of surface residue.

Treatment Unit #2--Irrigated and non-irrigated pasture 0-12% slopes

Average precipitation is 16 inches; 80 frost free days
AUMs .5 to 3 acres per animal unit month (AUM)

Acres	Soils	Resource Problems
3,749	Simonton, Brinegar, Marshdale, and Strom with minor amounts of Riceton soils occurring on nearly level to strongly sloping low terraces, alluvial fans and bottom lands. Soils are very deep and well to poorly drained. Surface layers are predominantly loams. Available water capacity is high and very high.	--Declining levels of desirable species because of low levels of irrigation water management. --Soil compaction from Grazing in saturated conditions --Excess of organic matter, sediment, & nutrients from grazing and IWM. --Headcuts & concentrated flow from irrigation return lines and cattle access.

Treatment Unit #3--Riparian corridor, 0-4% slopes

Average precipitation is 16 inches; 80 frost free days
AUMs .5 to 6 acres per animal unit month (AUM)

Acres	Soils	Resource Problems
375	Marshdale, and Strom with minor amounts of Riceton soils occurring on nearly level to strongly sloping low terraces, alluvial fans and bottom lands. Soils are very deep and well to poorly drained. Surface layers are predominantly loams or clay loams. Available water capacity is high and very high. Seasonal high water table ranges from 1-5 feet for the Marshdale soils, and 2 to 4 feet for the Strom soils.	--Soil compaction from Grazing in saturated conditions --Grazed in sequence with cropland and extended season of grazing without rotations. --Impaired riparian and stream habitat conditions from lack of streambank stability, and cover. --Accelerated streambank erosion from past efforts of channel straightening and grazing on streambanks.

Treatment Unit #4--Rangeland, 0-60% slopes

Average precipitation is 17 inches; 70 frost free days

Acres	Soils	Resource Problems
12,463	Predominantly Roanhide, Earcree and Gaib with minor amounts of Elkcreek, Simonton, Lockman, Marshdale & Vodermaier & rock outcrop occurring on nearly level to steep foothills and mountains with the minor soils occurring on low terraces, alluvial fans and bottom lands. Soils are very deep and well to poorly drained. Surface layers are predominantly loams or clay loams. Available water capacity is low to very high. Seasonal high water table ranges from 1-5 feet for the Marshdale soils, and 2 to 4 feet for the Strom soils.	--Sediment transport to surface waters from steep rangelands and declining range conditions. --Destabilized riparian areas from increased runoff from rangelands.

Treatment Unit #5--Animal Facilities

Units	Soils	Resource Problems
5	These facilities are found on Marshdale and Brinegar loam soils occurring on nearly level to slightly bottomlands and low terraces.	Animal waste directly impacts beneficial uses and affects water quality.

Table 17. Camas Creek Subbasin Treatment Unit Summary

Critical acres by Subwatershed												
TU	**Soldier**	**Willow**	**Beaver**	**Camp**	**Elk**	**Corral**	**Cow**	**Wild Horse**	**McKinney**	**Dairy**	**Camas**	**TOTAL ACRES**
1	320	22	0	330	115	0	0	0	0	0	2820	5,257
2	1650	910	0	0	35	930	0	0	0	0	244	3,769
3	43.5	17	19	7.45	15.9	85	18.8	10.6	63	41	54	375.25
4	4000	3380	19	0	0	0	660	0	0	4390	14	12,463
5	1.5	3.5	0	0	0	0	0	0	0	0	0	5
Total Acres	6015	4332.5	38	337.45	165.9	1015	678.8	10.6	63	4431	3132	21869.25

Recommended BMPs and Estimated Costs

For each TU, specific BMPs can be installed to address the unique resource problems for that TU as described in the prior section. These recommended BMPs and their estimated costs based on the Camas County NRCS cost share list (2006) and the Camas Soil Conservation District BMP Cost List (2007) are listed in Table 18.

Table 18. Recommended BMPs and Estimated Costs for TMDL Agricultural Implementation

Treatment Unit	Best Management Practice	Unit Type	Unit Cost	Unit Amount	Cost Share Funds	Participant Funds	Total Funds
TU 1 Cropland 4,124 acres	Irrigation Water Management	acre	$2.00	2770	$4,155.00	$1,385.00	$5,540.00
	Pasture and Hayland Planting	acre	$70.00	300	$15,750.00	$5,250.00	$21,000.00
	Irrigation System Center Pivot	acre	$600.00	1260	$567,000.00	$189,000.00	$756,000.00
				Subtotal	**$586.905.00**	**$195,635.00**	**$782,540.00**
TU 2 Pasture 3,749 acres	Fence 4-wire	foot	$1.15	21000	$181,125.00	$60,375.00	$24,150.00
	Spring Development	each	2,500.00	26	$48,750.00	$16,250.00	$65,000.00
	Pipeline PVC 1.25"	foot	$2.16	27,720	$44,906.00	$14,969.00	$59,875.25
	Watering Facility, Trough	each	$2,500.00	52	$97,500.00	$32,500.00	$130,000.00
	Pasture and Hayland Planting	acre	$70.00	760	$39,900.00	$13,300.00	$53,200.00
	Water well	foot	$32.00	1200	$230,400.00	$76,800.00	$307,200.00
				Subtotal	**$642,581.00**	**$214,194.00**	**$639,425.25**
TU 3 Riparian Corridor 375 acres	Streambank Protection						
	Willow Plantings	foot	$2.50	35,000	$65,625.00	$21,875.00	$87,500.00
	Log/rootwad/rock revetment	each	$400.00	25	$7,500.00	$2,500.00	$10,000.00
	Large Rock Armoring	foot	$39.00	1100	$32,175.00	$10,725.00	$42,900.00
	Log/ Tree Revetment	foot	$39.00	600	$17,550.00	$5,850.00	$23,400.00
	Rock Barb	each	$575.00	60	$25,675.00	$8,625.00	$34,500.00

Treatment Unit	Best Management Practice	Unit Type	Unit Cost	Unit Amount	Cost Share Funds	Participant Funds	Total Funds
TU 3 continued Riparian Corridor 375 acres	Grade Stabilization						
	Rock Chute	each	$1,300.00	30	$29,250.00	$9,750.00	$39,000.00
	Rock Keyed Log Drop	each	$750.00	32	$18,000.00	$6,000.00	$24,000.00
	Brush Check	each	$600.00	50	$22,500.00	$7,500.00	$30,000.00
	Dike Class III Fiber Coir 12"	foot	$4.30	800	$2,580.00	$860.00	$3,440.00
	Stream Channel Stabilization						
	Heavy Use Protection Area	each	$2,500.00	4	$7,500.00	$2,500.00	$10,000.00
	Fence						
	4-wire Barbed	foot	$1,15	104,400	$90,045.00	$30,015.00	$120,060.00
	Livestock Exclusion	acre	$14.00	4000	$42,000.00	$14,000.00	$56,000.00
	Offsite Watering Facility	each	$2,500.00	20	$37,500.00	$12,500.00	$50,000.00
				Subtotal	**$397,900.00**	**$132,700.00**	**$530,800.00**
TU 4 Rangeland 12,463 acres	Fence	foot	$1,15	31,600	$27,324.00	$9,106.00	$36,432.00
	Pipeline PVC 1.25"	foot	$2.16	75,240	$121,888.60	$40,629.00	$162,518.40
	Spring Development	each	$2,500.00	45	$84,375.00	$28,125.00	$112,500.00
	Watering Facility, Trough	each	$2,500.00	45	$84,375.00	$28,125.00	$112,500.00
	Pond	each	$4,500.00	11	$37,125.00	$12,375.00	$49,500.00
				Subtotal	$335,089.00	$116,155.00	$473,450.40
TU 5 Animal Facilities	Corral Relocation	foot	$11.00	2800	$23,100.00	$7,700.00	$308,000.00
	Conservation Cover	acre	$100.00	5	$375.00	$125.00	$500.00
				Subtotal	**$23,475.00**	**$7,825.00**	**$308,500.00**
TOTAL					**$1,985,960.00**	**$734,509.00**	**$2,734,715.00**

Treatment Alternatives

The Camas, Elmore, and Blaine Soil Conservation Districts will determine treatment alternatives for agricultural critical acres in the Camas Creek Subbasin based on the information contained in this TMDL Implementation Plan and available funding sources.

Funding

Financial and technical assistance for installation of BMPs is needed to ensure success of this implementation plan. Districts working in the Camas Creek Subbasin will actively pursue multiple potential funding sources to implement water quality improvements on private agricultural and grazing lands. Many of these programs can be used in combination with each other to implement BMPs. These sources include (but are not limited to):

CWA 319 –These are Environmental Protection Agency funds allocated to the Nez Perce Tribe and the State of Idaho. The Idaho Department of Environmental Quality (DEQ) administers the Clean Water Act §319 Non-point Source Management Program for areas outside the Nez Perce Reservation. Funds focus on projects to improve water quality and are usually related to the TMDL process. The Nez Perce tribe has CWA 319 funds available for projects on Tribal lands on a competitive basis. Source: DEQ http://www.deq.idaho.gov/water/prog_issues/surface_water/nonpoint.cfm#management

Water Quality Program for Agriculture (WQPA) –The WQPA is administered by the Idaho Soil Conservation Commission (ISCC). This program is also coordinated with the TMDL process. Source: ISCC http://www.scc.state.id.us/programs.htm

Resource Conservation and Rangeland Development Program (RCRDP) –The RCRDP is a loan program administered by the ISCC for implementation of agricultural and rangeland best management practices or loans to purchase equipment to increase conservation. Source: ISCC http://www.scc.state.id.us/programs.htm

Conservation Improvement Grants – These grants are administered by the ISCC. Source: ISCC http://www.scc.state.id.us/programs.htm

PL-566 –This is the small watershed program administered by the USDA Natural Resources Conservation Service (NRCS).

Agricultural Management Assistance (AMA) –The AMA provides cost-share assistance to agricultural producers for constructing or improving water management structures or irrigation structures; planting trees for windbreaks or to improve water quality; and mitigating risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming. Source: NRCS http://www.nrcs.usda.gov/programs/ama/

Conservation Reserve Program (CRP) –The CRP is a land retirement program for blocks of land or strips of land that protect the soil and water resources, such as buffers and grassed waterways. Source: NRCS http://www.nrcs.usda.gov/programs/crp/

Conservation Technical Assistance (CTA) –The CTA provides free technical assistance to help farmers and ranchers identify and solve natural resource problems on their farms and ranches. This might come as advice and counsel, through the design and implementation of a practice or treatment, or as part of an active conservation plan. Source: local Conservation District and NRCS: http://www.nrcs.usda.gov/programs/cta/

Environmental Quality Incentives Program (EQIP): EQIP offers cost-share and incentive payments and technical help to assist eligible participants in installing or implementing structural and management practices on eligible agricultural land. Source: NRCS http://www.nrcs.usda.gov/programs/eqip/

Wetlands Reserve Program (WRP) –The WRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. Easements and restoration payments are offered as part of the program. Source: NRCS http://www.nrcs.usda.gov/programs/wrp/

Wildlife Habitat Incentives Program (WHIP) –WHIP is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Cost-share payments for construction or re-establishment of wetlands may be included. Source: NRCS http://www.nrcs.usda.gov/programs/whip/

State Revolving Loan Funds (**SRF) –**These funds are administered through the ISCC. Source: ISCC http://www.scc.state.id.us/programs.htm

Grassland Reserve Program (GRP) –The GRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance grasslands on their property. Source: NRCS. http://www.nrcs.usda.gov/programs/GRP/

Conservation Security Program (**CSP) –**CSP is a voluntary program that rewards the Nation's premier farm and ranch land conservationists who meet the highest standards of conservation environmental management. Source: NRCS http://www.nrcs.usda.gov

Grazing Land Conservation Initiative (**GLCI) –**The GLCI's mission is to provide high quality technical assistance on privately owned grazing lands on a voluntary basis and to increase the awareness of the importance of grazing land resources. Source: http://www.glci.org/

HIP – This is an Idaho Department of Fish and Game program to provide technical and financial assistance to private landowners and public land managers who want to enhance upland game bird and waterfowl habitat. Funds are available for cost sharing on habitat projects in partnership with private landowners, non-profit organizations, and state and

federal agencies. Source: IDFG
http://fishandgame.idaho.gov/cms/wildlife/hip/default.cfm

Partners for Fish and Wildlife Program in Idaho – This is a U.S. Fish and Wildlife program providing funds for the restoration of degraded riparian areas along streams, and shallow wetland restoration. Source: USFWS http://www.fws.gov/partners/pdfs/ID-needs.pdf

Outreach

Conservation partners in the Camas Creek Subbasin will use their combined resources to provide information about BMPs to improve water quality to agricultural landowners and operators within the subbasin. A local outreach plan may be developed. Newspaper articles, district newsletters, watershed and project tours, landowner meetings and one-on-one personal contact may be used as outreach tools.

Outreach efforts will:

- Provide information about the TMDL process
- Supply water quality monitoring results
- Accelerate the development of conservation plans and program participation
- Enhance technology transfer related to BMP implementation
- Increase public understanding of agriculture's contribution to conserve and enhance natural resources
- Improve public appreciation of agriculture's commitment to meeting the TMDL challenge
- Identify and encourage the use of BMPs for recreation activities on the sub-basin

Monitoring and Evaluation

Field Level

At the field level, annual status reviews will be conducted to insure that the contracts are on schedule and that BMPs are being installed according to standards and specifications. BMP effectiveness monitoring will be conducted on installed projects to determine installation adequacy, operation consistency and maintenance, and the relative effectiveness of implemented BMPs in reducing water quality impacts. This monitoring will also measure the effectiveness of BMPs in controlling agricultural nonpoint-source pollution. These BMP effectiveness evaluations will be conducted according to the protocols outlined in the Agriculture Pollution Abatement Plan and the ISCC Field Guide for Evaluating BMP Effectiveness.

The Revised Universal Soil Loss Equation (RUSLE) and Surface Irrigation Soil Loss (SISL) Equation are used to predict sheet and rill erosion on non-irrigated and irrigated lands. The Alutin Method, Imhoff Cones, and direct-volume measurements are used to determine sheet and rill irrigation-induced and gully erosion. Stream Visual Assessment Protocol (SVAP) and Streambank Erosion Condition Inventory (SECI) are used to assess aquatic habitat, streambank erosion, and lateral recession rates. The Idaho OnePlan's CAFO/AFO Assessment Worksheet is used to evaluate livestock waste, feeding, storage, and application areas. The Water Quality Indicators Guide is utilized to assess nitrogen, phosphorus, sediment, and bacteria contamination from agricultural land.

Watershed Level

At the watershed level, there are many governmental and private groups involved with water quality monitoring. The Idaho Department of Environmental Quality uses the Beneficial Use Reconnaissance Protocol (BURP) to collect and measure key water quality variables that aid in determining the beneficial use support status of Idaho's water bodies. The determination will tell if a water body is in compliance with water quality standards and criteria. In addition, IDEQ will be conducting five-year TMDL reviews.

Annual reviews for funded projects will be conducted to insure the project is kept on schedule. With many projects being implemented across the state, ISCC developed a software program to track the costs and other details of each BMP installed. This program can show what has been installed by project, by watershed level, by sub-basin level, and by state level. These project and program reviews will insure that TMDL implementation remains on schedule and on target. Monitoring BMPs and projects will be the key to a successful application of the adaptive watershed planning and implementation process.

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Appendix

Appendix 1: Geothermal Influence on Water Temperatures

The following is an excerpt from: Goethermal Investigations in Idaho Geochemistry and Geologic Setting of the Thermal waters of the Camas Prairie area, Blaine and Camas, Idaho. Idaho Department of Water Resources – Water Information Bulletin NO.30 September 1979.

Abstract

The thermal waters of east-west trending intermountain basin making up the Camas Prairie areas were sampled during the fall of 1973. Average ground water temperature is 15°C (10°C above mean annual temperature). The thermal waters, chemically similar to thermal waters discharging from granitic rocks elsewhere in Idaho, have high pH, high Na/K and Na/Ca rations, and high fluoride content. They are low in total dissolved solids (less than 365 mg/l), low in chloride, and exhibit relatively constant chloride/fluoride ratios and silica concentrations.

Geothermal Gradient and Heat Flow

Although not extremely reliable as predictors of drilling depths, geothermal-gradient measurements have been used in geothermal investigations to establish boundary conditions or possible limits to which one might reasonably expect water to be circulating. A temperature-versus-depth plot (Figure. 7) for cold-water wells in the Camas Prairie area was made by Walton (1962, p. 40), who obtained a geothermal gradient of 92°C per km from this plot. This gradient has been confirmed by actual gradient measurements in water wells in the Camas Prairie area by Brott and others (1976). This gradient is much higher than the normal geothermal gradient of 33C per km. An average geothermal gradient of this magnitude extending uniformly to great depths suggests that a temperature of 200°C would exist at a depth of approximately 2,000 m. For a temperature of 85OC (approximately that observed at the surface for the hottest thermal water known in the Camas Prairie area), water would have to circulate to depths of less than 900 m. This geothermal gradient may decrease within the granitic rocks underlying the Prairie by approximately one-half due to thermal conductivity changes. Consequently, actual circulation depths to reach temperatures of 85 and 200°C may be proportionately greater.

The greater reliability of heat-flow measurements over simple temperature gradient measurements or calculations in assessing an area's geothermal potential is well known. The geothermal gradient may be viewed as the potential difference between the earth's deeper layers and that found at the surface, and is dependent on the ability of the intervening rock layers to conduct heat (thermal conductivity). Heat flow measurements take this thermal conductivity into account and, therefore, are uniform with depth, while abrupt and sometimes large variations in geothermal gradient occur with depth due to changes in thermal conductivity. A high heat flow, therefore, may indicate the presence of an intense heat source (regional or local) in the subsurface, while a high geothermal gradient may only reflect a lower thermal conductivity.

Although the thermal conductivity of the intervening rock layers in the Camas Prairie area is not exactly known, reasonable heat flow assumptions can be made by simply knowing the limits of thermal conductivity of the types of rocks found in the area. For example, unconsolidated, poorly sorted sands and gravels usually exhibit a thermal conductivity in thermal conductivity units (TCU) between 2.0 and 5.0 millicalories per centimeter per second per O C - milli~al/cm/~C sec giving a heat flow, in heat flow units (HFU), of from 9Z°C/km x 2.0 TCU = 1.8 microcalories per sq cm per sec (fical/cm2sec) (1.8 HFU) as a lower limit and 9Z°C/km x 5 TCU = 4.5 HFU as an upper limit. A heat flow of 3 HFU would be twice that which is considered normal (1.5 HFU) for most of the United States, but which appears to be typical of the margins of the Snake River Plain region (Brott and others, 1976).

This above normal heat flow appears typical of granitic terrains making up much of the complex Idaho batholith (Blackwell, 1973 unpublished data) and is high enough to reasonably expect that the thermal waters in the area could be reaching maximum temperature through deep circulation. The heat flow in the Camas Prairie area might be related to the Cretaceous granitic rocks of the Idaho batholith which are known to underlie the valley fill sediments in parts of the Prairie. The cause of this high heat flow is not known. Speculations are a crustal heat source or a mantle heat source due to crustal thinning.

Geothermal gradient measurements and heat flow calculations have not been made in the eastern portion of the Prairie area due to a lack of suitable bore holes. However, high heat flow in this part of the study area is indicated by its marginal position relative to the Snake River Plain and thermal water discharges near Magic Reservoir. A buried stock or sill, related perhaps to the Holocene basalt flows south of Magic Reservoir could conceivably underlie the area acting as a local, high intensity heat source.

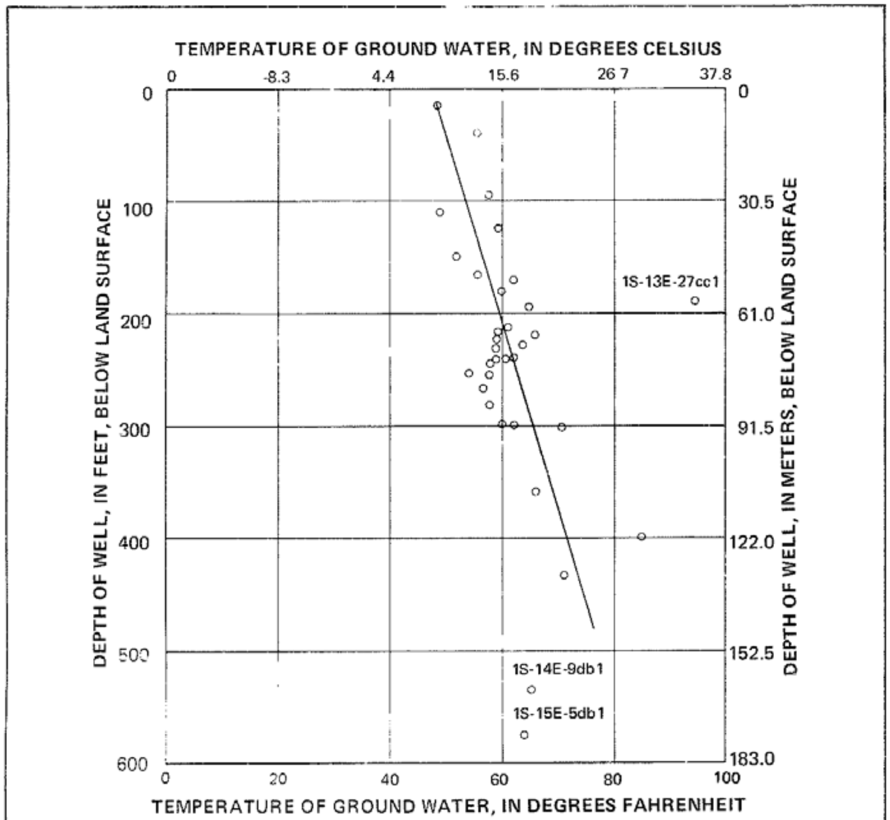

FIGURE 7. Variations of ground-water temperature with depth.
(Modified from Walton, 1962)

Idaho Department of Water Resources, Water Information Bulletin No. 30
Geothermal Investigations in Idaho, Part 7.
Geochemistry and Geologic Setting of the Thermal Waters of the Camas Prairie Area, Blaine and Camas Counties, Idaho
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